7 July 1989

Industrial Hygienist
EEB, OHA

0236

Site: ORONOGO
ID #: MOD980686281
Break: 1.6
Other:
7/7/89 LV

WORKING DRAFT FOR UPDATE 7 SITE

Mr. David Parker
Public Health Advisor
ATSDR Region VII

Attached is a WORKING DRAFT PRELIMINARY HEALTH ASSESSMENT for the following Update 7 site(s):

1. Oronogo-Duenweg Mining Belt, Jasper County, MO

Please review the draft and add any comments, corrections, or additions in the margins. Please rank your comments according to the following: A- necessary change for scientific or policy reasons, including things that are just plain wrong; B- recommended changes; C- suggested changes (you don't feel as strongly as B; and T- typographical errors. A and B comments must be, will be, resolved between us before the document is made final. If you wish, you can share with the RPM from EPA, or the State Project Officer as the case may be, for their unofficial comments or suggestions. Remember, their official comments must be in writing on letterhead.

Please ASYNC me if you have no substantial comments (or return the unmarked draft) or return the marked draft to me. Thank you for your help.

Cliff

Clifford L. Moseley

cc:
George Buynoski
Steve VonAllmen

DRAFT

PRELIMINARY HEALTH ASSESSMENT

ORONOGO-DUENWEG MINING BELT

JASPER COUNTY, MISSOURI

July 7, 1989

Prepared by:

Clifford L. Moseley

Agency for Toxic Substances and Disease Registry

SUMMARY

The Oronogo-Duenweg Mining Belt site has been proposed by the U.S. Environmental Protection Agency (EPA) for listing on the National Priorities List (NPL). Referred to as the Missouri portion of the Tri-State (Missouri, Kansas, and Oklahoma) Mining District, the site comprises approximately 20 square miles, and was the location of the most concentrated mining effort in the Tri-State District. Due to commercial zinc and lead mining operations that occurred from circa 1850 until the late 1960s, large open pits (some filled with water), tailings (called chat) piles, and subsurface horizontal mining shafts exist throughout the area. Shallow groundwater, surface water, sediment, and surface soil are contaminated with heavy metals zinc, lead, cadmium, and nickel. Population centers in the area use the deeper aquifer for water supplies; individual households outside these centers rely upon the shallow aquifer for water.

Based on the available information, this site is considered to be of potential public health concern because of the risk to human health caused by the possibility of exposure to hazardous substances via contaminated groundwater, soil, sediment, and air. Levels of heavy metals found in private wells so far do not appear to pose a significant public health threat alone, but may be a significant contribution to the overall exposure experienced by residents of the Oronogo-Duenweg Mining Belt. Recommendations for soil and air sampling, ~~and~~ a well survey, and a suggestion for developing an accident database relative to the physical hazards remaining from the mining operations are presented.

[illegible]

[illegible] abandoned, and [illegible] the [illegible] [illegible] and became [illegible] [illegible] the independent mine [illegible] to another location and sink another shaft. [illegible] would be mined in a vertical and outward direction until it too was depleted. [illegible] connected with [illegible]

REPORTED COMMUNITY HEALTH CONCERNS

No community health concerns have been reported to ATSDR.

DEMOGRAPHICS, LAND AND RESOURCE USE

Surface water, including Center and Shoal Creeks and pit water, may be used for crop irrigation and livestock watering, and sport fishing. Some pits have commercial uses, at least one is used as a SCUBA diving training facility. Some pits are large enough to be part of recreational parks and used for swimming and boating.

The city of Joplin obtains its water from Shoal Creek, with the intake located downstream from many tailings piles. Smaller towns in the Oronogo-Duenweg area (Webb City, Oronogo, Duenweg, Carterville) use the deep aquifer as the primary source of drinking water. People living outside of these small towns use private wells set in the shallow aquifer. One estimate of the size of the population using shallow groundwater for domestic water supply is 1,500. The deep aquifer is separated from the shallow aquifer by impermeable shales.

c recreational

The human activities within the site boundaries include industrial, commercial, and retail establishments, service industries, and residential areas. There are potentially sensitive populations within the site boundaries, such as children and elderly, schools, hospitals, and nursing homes.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

The generally accepted concepts of on- and off-site contamination are difficult to apply here, due to the very large area under evaluation and the possibility that contaminants may be spread widely by surface water flow, groundwater migration, and atmospheric dispersion. For the purposes of this preliminary health assessment, we will consider the 20 square mile area delineated in the site map specifically and the Tri-State Mining District in general as being subject to the public health evaluation process. Accordingly, all the data collected relative to this site will be considered to be on-site data.

In addition to the heavy metals listed in Table 1, nickel and mercury were found also. However, the concentrations reported are believed to be sufficiently low that, at this time, we do not feel that these metals are of public health concern.

A. ON-SITE ENVIRONMENTAL CONTAMINATION

The data collected so far in this evaluation is summarized in Table 1. The environmental media and concentration ranges are presented.

B. QUALITY ASSURANCE AND QUALITY CONTROL OF AVAILABLE DATA

Little information regarding quality assurance and quality control was provided. We assume that the data are of sufficient quality for the purposes of this preliminary health assessment.

Table 1
On-Site Environmental Concentrations
Oronogo-Duenweg Mining Belt

ENVIRONMENTAL MEDIA	SUBSTANCE	CONCENTRATION RANGE	
	August 1976		
Groundwater	zinc	0.02- 8.8	ppm
Surface water	zinc	0.5 -35	ppm
	cadmium	0.0 - 0.06	ppm
	lead	0.0 - 1.3	ppm
	February 1986		
Private wells	zinc	6.1 - 8.0	ppm
	cadmium	0.01- 0.03	ppm
	lead	0.08	ppm
Sediment	zinc	39	ppm
	cadmium	0.01- 0.25	ppm
	lead	0.3 - 7.3	ppm
	August 1986		
Private wells	zinc	0.2 -11	ppm
	cadmium	0.03- 0.04	ppm
	lead	ND	
	February 1988		
Private wells	zinc	0.05- 9.1	ppm
	cadmium	ND - 0.04	ppm
	lead	ND - 0.04	ppm
	November 1988		
Private wells	zinc	ND - 2.5	ppm
	cadmium	ND - 0.02	ppm
	lead	ND - 0.05	ppm

C. PHYSICAL AND OTHER HAZARDS

The remains of mining activity are so vast that public access restrictions, such as fencing or posting, would be of little use. A U.S. Bureau of Mines survey in 1983 showed that there were over 1,500 open mine shafts and nearly 500 subsidence features in the Tri-State district, with 124 in Missouri. Damage to buildings and roads above shaft areas and underground mine workings, and accidents to people and livestock, have been reported. However, no confirmatory or statistical information is available.

PATHWAYS ANALYSES

A. ENVIRONMENTAL PATHWAYS (Fate and Transport)

Mining and milling increases the amount of heavy metals available for dissolution by decreasing the ore particle size and increasing the surface area of the particle. When the ore body contains sulfates, as sphalerite (zinc sulfate) and galena (lead sulfite) do, acidic solutions can form as groundwater comes in contact with the exposed ore or chat or as rainwater percolates through the piles. Increasing contact time results in greater amounts of lead, zinc, and sulfate going into solution, causing groundwater and surface water contamination. Solutions with long residency times may reach highly acidic conditions. Surface water migration results in the movement, as sediment, of the smaller waste ore particles deposited on the land surface. In addition, mining and machining (milling) of ore results in the formation of smaller and smaller particles, some of which readily can become airborne. Smelting causes the formation of even smaller and more aerodynamic particles.

Groundwater, surface water, and sediment contamination by heavy metals has been documented. Although not confirmed by sampling, surface soil is contaminated, undoubtedly in the areas of and on the chat piles, and probably in surrounding areas due to

...ming a water intake of 2 liters per day for an adult, would result in an intake from water alone of 22 mg per day (equivalent to a dose of 0.3 mg/kg/day for a 70 kilogram adult). Although the health effects of long-term exposure of humans by drinking water containing zinc at this level are not known, 0.3 mg/kg/day is about 3 times the lowest estimated No Observed Adverse Effect Level (NOAEL) reported in (1b). Coupled with as yet unknown concentrations in air, food, and soil, excessive exposure to zinc may be occurring to residents of the Oronogo-Duenweg Mining area.

Exposure to lead is particularly dangerous for the fetus, because of its great sensitivity during development, and for young children, because they ingest more lead through normal mouthing activity, absorb more of the lead they ingest, and are more sensitive to its effects. Exposure to the mother during pregnancy is important since lead can transfer to the fetus, resulting in preterm birth, reduced birth weight, and decreased intelligence quotient (IQ) in the infant. There are reports of kidney tumors in laboratory animals fed large doses of lead; the evidence is insufficient to suggest that lead causes cancer in humans, and occupational studies have not supported this causal relationship. As a toxicant serving no known physiological requirement, the presence of lead at any level in the body is less than optimal. Current scientific thinking holds that there may be a risk of some adverse health effect at any level of lead exposure, even though current epidemiological and analytical methodology may not be sensitive enough to measure these effects. Most of the studies on lead effects in humans report data in terms of blood lead levels (micrograms lead/deciliter of blood (ug/dL). Typical blood lead levels in children, derived from intake calculations considering all routes of exposure (air, food, beverages, water, soil ingestion), range from roughly 3 ug/dL in the least exposed cases to 17 ug/dL in the worst cases. Using the data of Pocock (5b), the blood lead level resulting from ingesting groundwater at the highest concentration reported here (0.04 ppm), would be approximately 2.4 ug/dL, or on the low end of the exposure spectrum. On the other hand, the average baseline intake of lead by 2-year old, non-pica, non-urban children has been estimated to be 46.6 ug/day, with 25.1 ug from food, water, and beverages, 0.5 ug from inhaled air, and 21 ug from ingested dust. Considering only the groundwater, the exposure would be 40 ug/day which, when added to the as yet unknown levels of exposure from inhaled air, inhaled and ingested dust, and ingested soil or food, could indicate excessive lead exposure to children and perhaps adults in the Oronogo-Duenweg Mining area.

The health effect of primary importance from cadmium ingestion is kidney injury (kidney stones). Inhalation of airborne cadmium may cause lung disease, including cancer. Cadmium is a common element; typically, the most important source of cadmium exposure for humans is ingestion of food. Consumption of 15-30 ug/day is common. Long-term uptake of up to about 350 ug/day for an adult is believed to have relatively little risk of causing injury to the kidney or to other tissues. Consumption of groundwater contaminated with 0.04 ppm cadmium would result in an intake of about 80 ug/day. Exposure from groundwater alone does not appear to be a public health problem. However, as yet unknown contributions from inhaled air and dust and ingested foodstuffs and soil may result in excessive cadmium exposure to residents of the Oronogo-Duenweg Mining area.

ATSDR has prepared, or will prepare, Toxicological Profiles on the site contaminants noted above.

CONCLUSIONS

Based on the available information, this site is considered to be of potential public health concern because of the risk to human health caused by the possibility of exposure to hazardous substances via contaminated groundwater, soil, sediment, and air.

The concentrations reported in groundwater from private wells do not appear at this time to pose a significant public health threat. However, a comprehensive well survey and statistically-based sampling program appears necessary in order to determine if the groundwater concentrations reported so far are representative of the current state of contamination. From the limited data in Table 1, no distinctive trend in concentrations is discernible.

Information on heavy metal concentrations in air and soil is needed.

RECOMMENDATIONS

The particle size distribution of the chat piles should be determined in order to help predict the inhalation exposure potential.

A database of the accidents/injuries resulting from the open mine shafts and other physical hazards remaining from the mining operations should be considered. Whether or not some sort of intervention strategy (posting, notification by mail, etc.) is necessary could be based on the conclusions drawn from these data.

Further environmental characterization and sampling of the site and impacted off-site areas during the Remedial Investigation and Feasibility Study (RI/FS) should be designed to address the environmental and human exposure pathways discussed above. When additional information and data become available, e.g., the completed RI/FS, such material will form the basis for further assessment by ATSDR at a later date.

PREPARERS OF THE REPORT

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REFERENCES

The following documents were provided to ATSDR for review. These documents form the basis of this preliminary health assessment. Further information made available after the development of this preliminary health assessment will be addressed in any subsequent health assessment.

1a. U.S. Environmental Protection Agency. Site Evaluation for Oronogo-Duenweg Mining Belt, Jasper County, MO. Ecology and Environment, Inc. March 1987.

2a. U.S. Environmental Protection Agency. Final Report for Tri-State Mining Area, Joplin, MO. Ecology and Environment, Inc. June 27, 1986.

3a. U.S. Environmental Protection Agency. Hazard Ranking System Package. February 7, 1986.

4a. Weatherford, J. Trip Report and Data Summary; Tri-State Mining/Jasper. September 12, 1986.

5a. U.S. Environmental Protection Agency. Transmittal of Laboratory Data. September 4, 1986.

6a. Association of Missouri Geologists. Guidebook to the Geology and Environmental Concerns in the Tri-State Lead-Zinc District, Missouri, Kansas, Oklahoma. 33rd. Annual Meeting and Field Trip, September 26-27, 1986.

7a. U.S. Environmental Protection Agency. Transmittal of Laboratory Data. March 29, 1988.

8a. Department of Natural Resources, State of Missouri. Letter to Jasper county Public Water Supply District 1, transmitting laboratory data. December 12, 1988.

Additional references were consulted in the preparation of this preliminary health assessment.

1b. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Cadmium. Atlanta, Georgia: ATSDR, March 1989; ATSDR publication no. TP-88/08.

2b. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Zinc. Atlanta, Georgia: ATSDR, December 1988 (in draft).

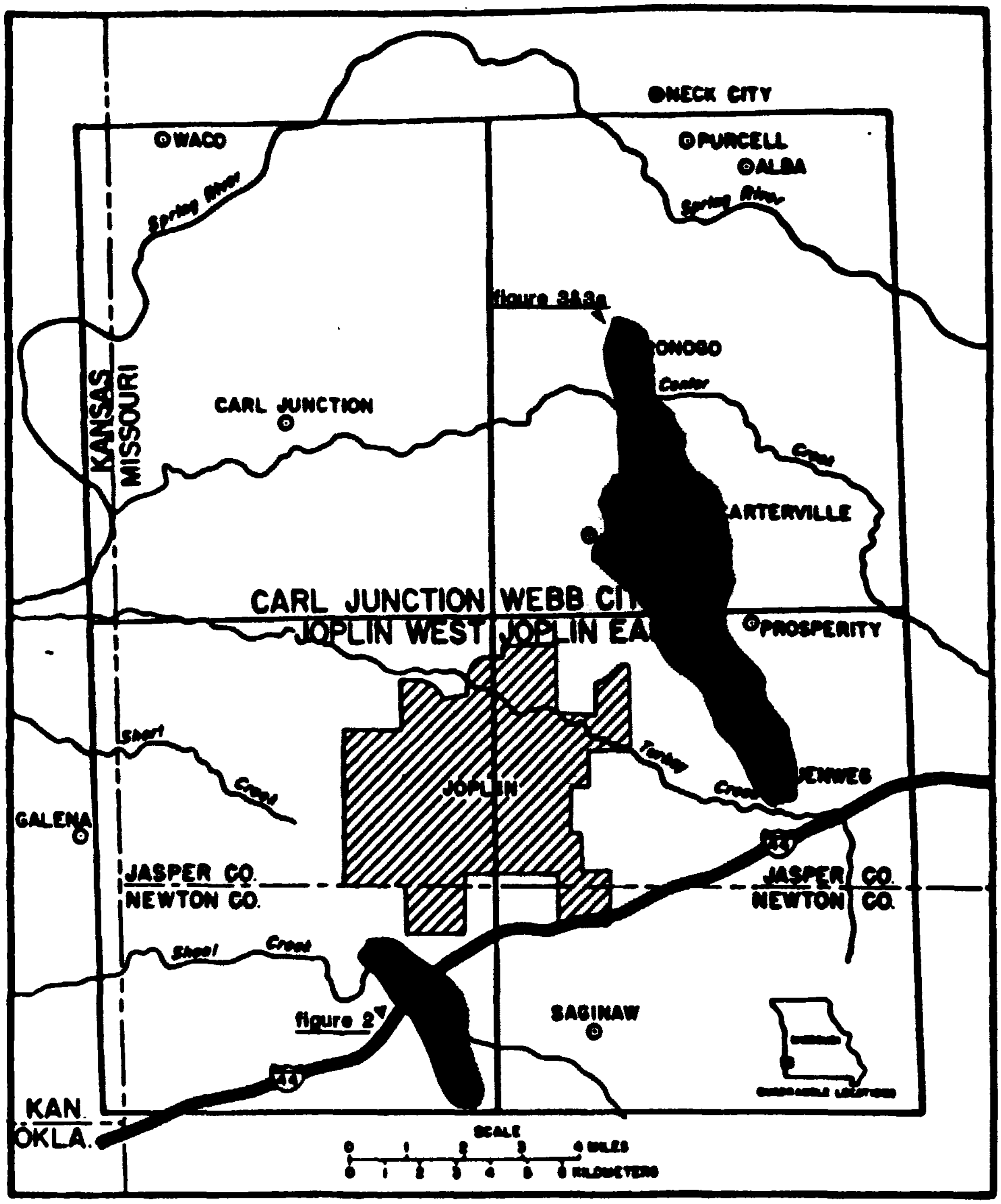
3b. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Lead. Atlanta, Georgia: ATSDR, February 1988 (in draft).

[illegible]

2. [illegible] lead, water hardness, alkalinity, and [illegible] concentrations. [illegible]

APPENDICES

Site map, Oronogo-Duenweg Mining Belt, Jasper County, Missouri.



SITE MAP: Missouri study area, Tri-State District, showing U.S.G.S. quadrangle coverage.

ATTENTION

One or more of the images associated with this document may be difficult to read. This is due to the quality of the original

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